

## CHEMICAL COMPOSITION OF RAINS AND SNOWS AT MOUNT VERNON, IOWA

551.510.4 : 551.573 (777) By LAWRENCE KYNETT and JOHN LOHNER

[Cornell College, Mount Vernon, Iowa, September 17, 1929]

The analyses of the precipitations of rains and snows at Mount Vernon, Iowa, were made under the direction of Dr. Nicholas Knight, professor of chemistry at Cornell College. Altogether there were 46 samples studied from October 4, 1928, to June 9, 1929. There were 37 specimens of rain, 7 of snow, and 2 of both rain and snow.

The precipitations are collected in clean, granite pans, 17 inches in diameter, kept away from trees and buildings. The village, exclusive of the college, has a population of about 1,700, with no factories. The sulphuric acid must come mainly from the coal used in the private heating plants.

The methods employed in the analysis are taken from Standard Methods of Water Analysis, sixth edition, published by the American Public Health Association. The work has been carried on in a laboratory devoted exclusively to water analysis, in which no ammonia is allowed. In the test for chloride we have found it necessary to deduct 3.55 parts per million from the reading to allow for the formation of the color.

The precipitations usually come from the east or the south which signifies that the salt as represented by the chlorine is borne several hundred miles from the Atlantic Ocean or Gulf of Mexico. The salt spray caught by the winds is borne across the continent to the place of precipitation.

The distillation method for the free and albuminoid ammonia is employed. The phenolsulphonic method is used with the nitrates. Practically all of the samples were colorless. The results of the investigation are given in the following tables.

TABLE 2.—Data from Table 1 converted into pounds per acre

Date	Rain or snow <sup>1</sup>	Chlorine	Free ammonia	Albuminoid ammonia	Nitrate	Nitrite	Sulphate
Oct. 4	Rain, 0.5 inch.....	0.30	0.04	0.031	0.0008	Trace.	None.
12	Rain, 0.75 inch.....	.46	.0007	.04	.004	Trace.	None.
13	Rain, 0.6 inch.....	.33	.028	.006	.0003	Trace.	None.
16	Rain, 0.42 inch.....	.24	.033	.018	.0002	0.00002	None.
17	Rain, 0.7 inch.....	.32	.06	.032	.0003	None.	None.
19	Rain, 0.15 inch.....	.32			.0002	None.	None.
21	Rain, 0.33 inch.....	.17	.027	.0008	.0015	None.	None.
22	Rain, 0.6 inch.....	.17	.0005	.0005	.0003	None.	None.
28	Rain, 0.15 inch.....	.18	.0009		.001	None.	None.
Nov. 1	Rain, 0.18 inch.....	.11	.0016	.013	.0008	.00002	None.
2	Rain, 0.92 inch.....	.034	.0004	.013	.004	.00001	None.
7	Rain, 0.42 inch.....	.16	.004	.005	.001	.0005	None.
9	Both; rain, 0.25 inch.....	.22	.08	.024	.00073	.000008	0.11
14	Rain, 0.20 inch.....	.065	.008	.014	.0009	.00025	.11
17	Rain, 1.8 inches.....	1.80	.61	.28	.01	Trace.	None.
30	Rain, 0.72 inch.....	.43	.288	.032	.0048	Trace.	None.
Dec. 2	Rain, 0.27 inch.....	.119	.054	.014	.0015	Trace.	.013
14	Rain, 0.8 inch.....	.00933	.049	.036	.0013	Trace.	None.
Jan. 6	Snow, 3 inches.....	.21	.26	.091	.011	Trace.	.048
9	Both; rain, 5 inches.....	.104	.18	.027	.034	Trace.	.31
14	Snow, 3 inches.....	.078	.041	.037	.0008	Trace.	.25
18	Snow, 4 inches.....	.10	.049	.021	.003	None.	.11
22	Rain, 0.3 inch.....	.052	.10	.030	.002	Trace.	.11
24	Snow, 4 inches.....	.043	.027	.0114	.003	None.	1.61
Feb. 8	Snow, 3 inches.....	.092	.014	.0064	.00011	.00022	.0008
Mar. 11	do.....	.032	.018	.016	None.	.0001	.00054

<sup>1</sup> 1 inch of rain on an acre weighs 226,875 pounds; 12 inches of snow the equivalent of 1 inch of rain.

TABLE 2.—Data from Table 1 converted into pounds per acre—Con.

Date	Rain or snow <sup>1</sup>	Chlorine	Free ammonia	Albuminoid ammonia	Nitrate	Nitrite	Sulphate
Mar. 19	Snow, 5 inches.....	0.26	0.027	0.020	0.00095	0.00008	0.35
20	Rain, 0.5 inch.....	.39	.036	.032	None.	.0005	.00039
Apr. 1	Rain, 0.8 inch.....	.36	.0006	.047	None.	.0007	.0033
11	Rain, 0.9 inch.....	1.28	.098	.053	.0102	.00008	.0092
16	Rain, 0.1 inch.....	.91	.0073	.0055	None.	.00091	.011
19	Rain, 0.2 inch.....	.32	.013	.011	None.	Trace.	.004
20	Rain, 1 inch.....	.91	.055	.041	None.	Trace.	.028
25	Rain, 0.5 inch.....	.325	.0319	.025	Trace.	Trace.	.0011
27	Rain, 0.15 inch.....	.14	.0122	.0095	Trace.	Trace.	.0016
30	Rain, 0.48 inch.....	.285	.035	.03	Trace.	Trace.	.0003
May 11	Rain, 0.08 inch.....	.10	.006	.0054	.0004	Trace.	.00003
14	Rain, 0.25 inch.....	.35	.020	.016	None.	None.	.00021
23	Rain, 0.35 inch.....	.20			None.	Trace.	.0002
23	Rain, 0.08 inch.....	.12	.0063	.004	None.	.00011	.003
27	Rain, 0.45 inch.....	.27	.034	.032	None.	Trace.	.003
29	Rain, 0.33 inch.....	.20	.026	.024	None.	Trace.	.026
29	Rain, 0.5 inch.....	.47	.037	.032	None.	Trace.	.00024
June 4	Rain, 0.25 inch.....	.22	.018	.016	None.	Trace.	.00021
9	Rain, 0.8 inch.....	.86	.058	.050	None.	Trace.	.0016

TABLE I.—Parts per million

Date	Rain or snow <sup>1</sup>	Chlorine	Free ammonia	Albuminoid ammonia	Nitrate	Nitrite	Sulphate
Oct. 4	Rain, 0.5 inch.....	2.64	0.3600	0.2800	0.007	Trace.	Absent.
12	Rain, 0.75 inch.....	2.69	.0400	.2400	.022	Trace.	Absent.
13	Rain, 0.6 inch.....	2.33	.2000	.0400	.002	Trace.	Absent.
16	Rain, 0.43 inch.....	2.69	.3600	.1120	.002	0.0002	Absent.
17	Rain, 0.7 inch.....	1.98	.3600	.2000	.002	Trace.	Absent.
19	Rain, 0.15 inch.....	1.98	(1)		.001	Trace.	Absent.
21	Rain, 0.33 inch.....	2.33	.3600	.1120	.002	Trace.	Absent.
22	Rain, 0.60 inch.....	1.27	.4000	.4000	.002	Trace.	Absent.
28	Rain, 0.15 inch.....	5.18	.2600		.030	(1)	Absent.
Nov. 1	Rain, 0.18 inch.....	2.69	.0400	.3200	.020	.0005	Absent.
2	Rain, 0.92 inch.....	1.63	.0400	.0500	.010	.0005	Absent.
7	Rain, 0.42 inch.....	4.11	.9600	.1600	.007	.00014	Absent.
9	Both, 0.25 inch.....	3.91	1.4400	.4400	.013	.00014	1.95
14	Rain, 0.20 inch.....	1.45	1.800	.4300	.020	.0056	Absent.
17	Rain, 1.8 inches.....	1.98	1.4800	.6800	.025	Trace.	Absent.
30	Rain, 0.72 inch.....	2.69	1.8000	.2000	.030	Trace.	Absent.
Dec. 2	Rain, 0.27 inch.....	1.98	.9000	.2400	.025	Trace.	0.21
14	Rain, 0.8 inch.....	1.37	.7200	.2000	.007	Trace.	Absent.
Jan. 6	Snow, 12 inches.....	.92	1.1300	.4000	.050	Trace.	.21
9	Both, 0.5 inch.....	.92	1.6000	.2406	.030	Trace.	2.71
14	Snow, 3 inches.....	1.37	.7200	.6400	.015	Trace.	4.46
18	Snow, 4 inches.....	1.37	.6400	.2800	.040	Absent.	1.47
22	Rain, 3 inches.....	.69	1.2800	.4000	.025	Trace.	.52
24	Snow, 4 inches.....	.56	.3600	.1500	.040	Absent.	2.12
Feb. 8	Snow, 3 inches.....	1.62	.2000	.1120	.002	.0004	.0073
Mar. 11	do.....	.56	.3200	.2800	Absent.	.0002	.0064
19	do.....	2.69	.2500	.2000	.001	.0008	3.67
25	Rain, 5 inches.....	3.41	.3200	.2800	Absent.	.0004	.034
Apr. 1	Rain, 0.8 inch.....	1.99	.3600	.2600	Absent.	.0004	.0183
11	Rain, 0.9 inch.....	6.25	.4800	.2600	.05	.0004	.045
19	Rain, 0.2 inch.....	7.1	.2800	.2400	Absent.	.0002	.0894
16	Rain, 0.1 inch.....	4.0	.3200	.2400	Absent.	.0004	.0469
20	Rain, 1 inch.....	4.0	.2400	.1800	Absent.	.0001	.076
25	Rain, 1.7 inches.....	(1)	.32000	.2800	(1)	(1)	(1)
25	Rain, 0.5 inch.....	2.85	.2800	.2200	.001	.0005	.006
27	Rain, 0.15 inch.....	4.11	.3600	.2800	.001	.0001	.046
30	Rain, 0.48 inch.....	2.61	.3200	.2800	.001	.0001	.0026
May 11	Rain, 0.08 inch.....	5.46	.3400	.3000	.002	.0001	.0018
14	Rain, 0.25 inch.....	6.14	.3200	.2800	Absent.	Absent.	.0038
23	Rain, 0.35 inch.....	2.69	(1)	Absent.	.0001	.0029	.0029
23	Rain, 0.08 inch.....	6.55	.3500	.2000	Absent.	.0006	.0391
27	Rain, 0.45 inch.....	2.69	.3400	.2600	.001	.0002	.0045
29	Rain, 0.33½ inch.....	2.69	.3400	.3200	Absent.	.0001	.0034
29	Rain, 0.05 inch.....	4.1	.3200	.2800	Absent.	.0003	.0021
June 4	Rain, 0.25 inch.....	3.8	.2800	.2400	Absent.	.0002	.0036
9	Rain, 0.8 inch.....	4.8	.3200	.2800	Absent.	.0002	.0096

<sup>1</sup> Not enough sample.

<sup>2</sup> Sample ruined.